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PLANT INDUSTRY SUB-BRANCH

THE PLANT DISEASE REPORTER

Issued By

THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey
BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING
AGRICULTURAL RESEARCH ADMINISTRATION
UNITED STATES DEPARTMENT OF AGRICULTURE

SUPPLEMENT 174

REPORT OF THE SPECIAL COMMITTEE ON THE COORDINATION OF FIELD TESTS WITH NEW FUNGICIDAL SPRAYS AND DUSTS, WITH REFERENCE TO RESULTS OBTAINED IN 1947

Supplement 174 March 1, 1948

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE REPORTER SUPPLEMENT

Issued by

THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station Beltsville, Maryland

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Plant Disease Reporter
Supplement 174

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FOREWORD

This committee was authorized at the St. Louis meeting of the American Phytopathological Society in the spring of 1946 and was organized in the latter part of that year and early in 1947. The committee now consists of a general chairman (who is also a member of the General Fungicide Committee of the Society) and a number of sub-chairmen, each of whom is the chairman of a sub-committee responsible for tests conducted on a specific crop such as apples, potatoes, etc. In addition to these sub-chairmen in charge of specific crops, there are a number of advisory members upon whom the active members may call for advice and guidance. The complete membership of the committee is as follows:

Sub-chairmen in charge of crop divisions, --

Apples	J. M. Hamilton	Geneva, N. Y.
Carrots, celery, and onions	A. G. Newhall	Ithaca, N. Y.
Cucurbits	J. W. Heuberger	Newark, Del.
Ornamentals	A. W. Dimock	Ithaca, N. Y.
Potatoes	W. F. Buchholtz	Ames, Iowa
Stone and small fruits	H. F. Winter	Wooster, Ohio
Tomatoes	M. B. Linn	Urbana, Ill.

Advisory members, --

Agricultural Engineering	Frank Irons	USDA Eng. Lab., Toledo, Ohio
Chemistry	E. G. Witman	Sherwin-Williams Co. Cleveland, Ohio
Experiment Stations, U. S. D. A.	H. P. Barss	Office of Exp. Stations Washington, D. C.
Entomology	H. F. Dietz	DuPont Company Wilmington, Del.
Extension	O. C. Boyd	Agr. Exp. Station, Amherst, Mass.
Industry	L. G. Utter	Phelps Dodge Corp. New York, N. Y.
Plot design and data analysis	F. M. Wadley	Dept. Ent. & Pl. Quar. Washington, D. C.

General Chairman, -- J. D. Wilson Wooster, Ohio

Cooperating members are listed under each crop division in the following report.

Individual cooperators on this committee were obtained as follows: -- A circular letter was sent to the chairmen or heads of the departments of biology, botany, or plant pathology, as the case might be, of each state agricultural experiment station, asking if they would be kind enough to furnish a list of pathologists in their respective departments according to the crop units or groups upon which they worked. These names were then assembled and sent to the various sub-chairmen in charge of the different crops or crop groups. They in turn contacted each crop specialist concerning his willingness to join the cooperative group in the testing of a selected group of new fungicides, to be applied as sprays or dusts, for the control of specific diseases on a specific crop or group of crops.

After the cooperators on a given crop were known, the sub-chairman gave each a chance to indicate his choice of treatments from a selected list of materials that contained all likely prospects, ranking them as first choice, second choice, etc. These preferences were then assembled and totaled. Under this system the material with the lowest score was first choice and the highest score indicated last choice on a group basis. Since it was apparent that these cooperative tests had the best chance to succeed if the number of materials to be compared was kept at a minimum, only five or six treatments were selected for use on each crop. Accepted plot designs with four to six replicates of each treatment were used wherever possible, and the collection and recording of data was standardized for the crop. Each cooperator could, within limits, select his own crop variety, cultural practice, plot size, and type of spray equipment. All spray or dust materials were supplied by the respective manufacturers from single batches of material.

Each cooperator also agreed to submit a copy of his data, in-so-far as it related to the standard experiment, to his sub-chairman shortly after it had been obtained, for use in a general report on the experiment, with the understanding that he was to receive full credit for his contribution. Otherwise he was at liberty to use his individual data as he saw fit. It was also understood that each cooperator should receive a copy of the assembled report and summary from his sub-chairman.

These crop reports and summaries have in turn been assembled and are here submitted as the yearly report of the committee as a whole.

J. D. Wilson, General Chairman

The Committee wishes to express its gratitude to the following individuals for their help during the progress of this cooperative effort, - J. G. Horsfall, Connecticut Agricultural Experiment Station, for separates entitled "An Improved Grading System for Measuring Plant Disease"; F. M. Wadley, Bureau of Entomology and Plant Quarantine, for separates entitled "Notes on Experimental Designs and Use of Randomized Blocks"; and H. E. Bruner, Monsanto Chemical Co.; G. M. Juredine, Harshaw Chemical Company; F. B. Maughan, Rohm and Haas Chemical Co.; G. L. McNew, Naugatuck Chemical Co., (now at Ames, Iowa); A. A. Nikitin, Tennessee Copper Co.; B. L. Richards, duPont de Nemours Co.; and any others who cooperated in the shipment of fungicidal materials to the various cooperators.

INDEX OF FUNGICIDES AND CROPS ON WHICH THEY WERE USED IN THE VARIOUS TESTS

Fungicides	Crops
Arasan	Ornamentals
Bioquin 1	Apples, Carrots, onions and celery, Tomatoes
Bioquin 100	Apples, Stone and Small fruits
Bismuth subsalicylate	Ornamentals
Bordeaux mixture	Apples, Carrots, onions, and celery, Cucurbits, Ornamentals, Potatoes, Stone and Small fruits, Tomatoes.
Calogreen	Ornamentals
Ceresan	Ornamentals
COC-S	Carrots, onions, and celery, Potatoes, Stone and Small fruits
Copper A	Cucurbits
Copper zinc chromate	Tomatoes
Cuprocide	Cucurbits, Tomatoes
Cupro K	Stone and Small fruits
Dithane	Carrots, onions, and celery, Cucurbits, Potatoes, Tomatoes
Dowicide 98	Ornamentals
Fermate	Apples, Cucurbits, Ornamentals, Stone and Small fruits, Tomatoes
Glyoxalidine (341 A,B,or C)	Apples, Stone and Small fruits
Lysol	Ornamentals
Mn. ethylene bis	Carrots, onions, and celery
Parzate	Apples, Carrots, onions and celery, Cucurbits, Ornamentals, Potatoes, Stone and Small fruits, Tomatoes
P.E.P.S.	Apples
Phygon	Apples, Carrots, onions, and celery, Ornamentals, Potatoes, Stone and Small fruits, Tomatoes
PMAS	Apples
Puratized	Apples, Ornamentals
Sulfurs -- various	Apples, Ornamentals, Stone and Small fruits
Tenn. 26	Apples, Stone and Small fruits
Tenn. 34	Cucurbits
Tribasic	Carrots, onions, and celery, Cucurbits, Stone and Small fruits, Tomatoes
Zerlate	Apples, Carrots, onions, and celery, Cucurbits, Potatoes, Stone and Small fruits, Tomatoes

REPORT OF THE SECTION ON FUNGICIDE TESTS FOR THE CONTROL OF APPLE DISEASES, 1947

J. M. Hamilton

There were twenty-one cooperators of which nineteen were able to complete field tests. The data presented on the control of apple scab were taken from the reports of eleven cooperators who tested the greater number of the "suggested materials" in a basically complete spray schedule. The remainder of the data did not lend itself to condensation. The data pertaining to diseases other than scab were limited and will not be presented at this time. A complete report was made to the cooperators.

The degree of disease control on the fruit was selected as the best basis on which to organize the data. Information other than the percentage scab control given was obtained but is not included to avoid confusion.

These are discrepancies not noted but it was felt that these would not materially affect the over-all picture as may be interpreted from the data presented and the summation. Omissions or misinterpretations are possible. Valuable information may have been omitted, but it was necessary to keep to the original intent of the project in order to have an abbreviated report.

	Cooperators
Delaware	J. W. Heuberger and Spencer H. Davis
Illinois	Dwight Powell
Indiana	J. R. Shay
Maine	M. T. Hilborn
Maryland	J. C. Dunegan, and M. C. Goldsworthy
Massachusetts	O. C. Boyd, and E. F. Guba
Minnesota	E. O. Mader, and A. C. Hodson
Missouri	H. G. Swartwout
New Hampshire	E. J. Rasmussen, and M. C. Richards
New Jersey	Robert H. Daines
New York	J. M. Hamilton, and D. H. Palmiter
North Carolina	C. N. Clayton, and Robert Aycock
Ohio	H. C. Young, and H. F. Winter
Pennsylvania	F. H. Lewis, H. W. Thurston, Jr., and W. B. Chandler
Rhode Island	F. L. Howard
Virginia	A. B. Groves
West Virginia	C. F. Taylor
Wisconsin	J. Duain Moore

Table 1. New materials for the control of apple scab, 1947.
(Figures given indicate percentage of scab on fruit)

Treatment	Shay (Ind.) Gallia Beauty	Young & Winter (Ohio) Red Rome	Lewis (Pa.) Stayman	Palmiter (N.Y.) McIntosh	Hamilton (N.Y.) McIntosh	Daines (N.J.) Rome Beauty	Hilborn (Me.) McIntosh	Heuberger & Davis (Del.) Delicious	Taylor (W. Va.) Delicious	Rasmussen & Richards (N.H.) McIntosh	Swartwout (Mo.) Rome Beauty (A)	Swartwout (Mo.) Rome Beauty (B)
Unsprayed	99	98	-	100	99	54	28	37	-	-	100	67
Fermate 1 1/2-100	6	7	9	2	T	3	*3	*2	4	3	-	-
Puratized 1 pt.	20	9	6	2	1	5	T	2	7	4	4	1
Phygon 1/2-100	8	*1	*1	*1	21	10	T	*8	*T	*1	33	3
341C 1 qt.	7	6	-	5	T	-	2	-	1	-	16	-
341B 3-100	-	-	11	-	T	5	3	-	-	-	31	4
Copper-8 1-100	3	-	-	-	0	3	2	2	1	-	-	-
P.E.P.S. 2 qt.	25	-	-	13	-	10	*10	-	6	-	73	30
806 1 pt.	-	-	-	1	1	-	1	2	-	-	-	-
Micronized 5 or 6-100	19	14	-	3	23	2	-	-	*T	7	*10	-
Magnetic "70" 7 or 8-100	9	*5	2	-	-	-	-	-	-	4	-	-

* A higher or range of concentrations was used
Missouri blocks A and B were in the same orchard.

Table 2. Summation of the data obtained with new materials for the control of apple scab in ten States, 1947

Treatment*	Percent range of scab on fruit 0-5	6-10	11-25	25+
Micronized (8)	3	2	3	0
Fermate (10)	7	3	0	0
Puratized (12)	8	3	1	0
Phygon (12)	7	3	1	1
341C (7)	4	2	1	0
341B (6)	4	1	1	0
P.E.P.S. (7)	0	3	2	2
Copper-8 (5)	5	0	0	0
806 (4)	4	0	0	0

*()=Number of blocks in which materials were tested.

Summary

Fermate. On a protective basis, all factors considered, Fermate was the best material. It gave better control of the scab on the fruit than on the foliage. Fermate broke down late in the season, allowing scab to build up on the underside of the foliage. Fermate gave good control of apple blotch and Brook's fruit spot. The carbamates gave the best control of black rot (foliage data).

Puratized. Puratized failed seriously in one out of twelve orchards. It was reported to remove leaves bearing scab lesions and may be found to be injurious to some varieties, particularly if poor drying conditions prevail at the time the spray is applied. It was not compatible with Good-rite P.E.P.S. The maturity of apples was delayed as much as two weeks by the application of Puratized.

Phygon. Phygon was rated as one of the more effective materials during the primary infection period, but allowed secondary infection to develop at harvest time, presumably due to lack of retention. Injury was a factor on both fruit and foliage that cannot be overlooked. In one instance, it was reported to result in the build-up of red mite. Toxicity to humans was reported by several cooperators. Phygon was comparatively ineffective against apple blotch, Brook's fruit spot, and black rot.

341C and 341B (Glyoxalidine). The 341C gave approximately the same control of scab as Fermate, but severe injury occurred in New York (Hudson Valley), Virginia, West Virginia, and Wisconsin. The 341B did not give the disease control of 341C but did not cause injury.

Copper-8 (Bioquin 1). Copper-8 did not receive the critical testing of the other materials, but all reports were favorable. It requires a sticker to be most effective, as does the Phygon. Injury may be a factor if lime is not added. It gave good control of apple blotch and Brook's fruit spot.

Good-rite P.E.P.S. P.E.P.S. was completely ineffective in controlling scab in most of the orchards. It appeared to be a good sticker for some organics but will reduce the amount of control if the concentration is too high. It did not control Brook's fruit spot.

NEW YORK STATE AGRICULTURAL EXPERIMENT STATION, GENEVA

SUMMARY OF DATA ON COOPERATIVE FUNGICIDE TESTS ON ONIONS, CARROTS, AND CELERY FOR 1947

A. G. Newhall by J. D. Wilson

Comparatively few cooperators were obtained for this group of crops, largely because the number of pathologists in the country who are specializing on disease control on onions, carrots, and celery is very limited. Also, all of those who signified a willingness to cooperate may not be listed here since Dr. Newhall is now in Central America on sabbatic leave and his correspondence on the matter is not available. A group of promising fungicides for testing purposes on each crop was selected by those interested in the cooperative plan.

Onion

Those cooperators in the onion spraying experiment were:

G. H. Godfrey
A. G. Newhall, Chairman
E. C. Tims
J. D. Wilson

and the materials to be compared were:

Bordeaux mixture	5-2 1/2-100
COC-S	4-100
Zerlate	2-100
Dithane Z-78	2-100
Phygon	1-100

Downy mildew appeared in the experimental plots at Baton Rouge where it became severe, but was not present at Canastota or McGuffey. *Macrosporium* appeared but was scarce at McGuffey. It became quite severe at Bay View, Texas. Blast was present, but also mild in both the New York and Ohio tests. Results obtained by spraying in these four experiments were rather inconclusive and consequently disappointing. The data obtained, together with a short discussion of each test are given below.

Texas.

White Bermuda onions were planted in September. Purple blotch appeared about January 15. Onions were sprayed on January 22, February 13, February 21, and on March 1, with a knapsack sprayer at about 100 gal. per acre. The leaf data in the accompanying table were taken on March 10. The most critical periods from control standpoint probably were missed because of inaccessibility of plots.

The fact that a significant reduction of leaf damage was shown by spraying indicates that properly timed applications may be an economic procedure in a blight year. Striking differences between sprayed and non-sprayed plots were obvious during the growing season. Differences between treatments were not significant, however. (Table 1).

Table 1. Control of Macrosporium blight on onions at Bay View, Texas, by various fungicides.

G. H. Godfrey

Treatments	Yield in pounds per plot	Foliage condition. Mean No. of leaves per 10 plants that were, -- Healthy	Intermediate	Dead	Percent of leaves living
1. Dithane + ZnSo4 + lime 2-1-1/2-100	102	106	132	125	50.6
2. Fermate 2-100	85	108	134	122	52.0
3. Bordeaux 10-6-100	98	109	132	106	55.3
4. Dithane Z-78 2-100	94	101	127	123	53.1
5. COC-S 4-100	93	99	125	126	49.8
6. No treatment	89	63	84	133	38.7
L.S.D. at 5% level	--	18	--	--	5.5

DDT-25W used with each treatment

New York.

Table 2. Spray test for the control of onion foliage diseases at Canastota, New York, in 1947.

A. G. Newhall

Treatments	Yields pounds per 30 feet of row	Foliage condition. Mean no. of leaves per 50 plants that were, Completely dead	One-half dead	Completely green
No treatment	11.6	264	17.6	1.0
Zerlate 2-100	9.2	250	37.6	3.4
Dithane Z 2-100	11.3	249	40.0	2.6
Phygon 1-100	9.5	249	44.2	5.8
COC-S 4-100	9.6	236	47.6	4.0
Bordeaux 5-2 1/2-100	11.7	249	40.8	5.6

There was no significant difference between treatments in their ability to keep leaves green, and no treatment gave any signficant increase in yield over the untreated check, or over any other treatment. Diseases were scarce or absent, except for a small amount of blast. Triton X-100 used with all sprays as a wetting agent. Four spray applications were made at approximately weekly intervals (Table 2).

Louisiana.

Table 3. Control of onion mildew by various fungicides at Baton Rouge, Louisiana, 1947. Counts were made on 50 plants in each plot about one month before plants were pulled.

E. C. Tims

Treatment	Foliage condition. Mean number of leaves per 50 plants that were,-- Completely dead	One-half dead
No treatment	54	59
Zerlate 2-100	47	45
Dithane Z 2-100	45	47
Phygon 1-100	52	45
COC-S 4-100	49	51
Bordeaux 5-2 1/2-50	46	49

This test was arranged to study the control of downy mildew (Peronospora) on onions being grown for bulbs. The disease was well established before the first spray was applied. The test was discontinued after 6 applications at 4- to 5-day intervals because there were no apparent differences between treatments and none were giving satisfactory control. Dupont Spreader-Sticker was used at 1/2-100 in all sprays (Table 3).

Ohio.

Table 4. Spray test for the control of foliage diseases of onion at McGuffey, Ohio, in 1947.

J. D. Wilson

Treatments*	Yield in bushels per acre	Percent of foliage still green on August 27
No treatment	419	10
Zerlate 2-100	469	50
Dithane 2-100	472	35
Phygon 1-100	403	41
CCC-S	456	48
Bordeaux	443	39

* DDT 50-W was used with all fungicides at 1-100

Foliage diseases were absent or scarce in this experiment. There was a light infection of Macrosporium leaf spot. Thrips infestation became severe about 10 to 14 days before the natural maturity date and caused some damage. CCC-S and Bordeaux caused some tip burning in one of the early applications but did not cause any marked yield reduction. Phygon caused a mild form of foliage injury which did reduce yield somewhat. The plots treated with Zerlate and with COC-S were greenest during the last few days before ripening set in. There was no significant difference in appearance or yield from plots treated with Zerlate, Dithane, COC-S, or Bordeaux. Five spray applications were made at 10-day intervals (Table 4).

Carrot

Only two cooperators were obtained for the carrot spraying test. They were A. G. Newhall and J. D. Wilson. The materials used were:

Bordeaux	6-6-100	Dithane Z-78	2-100
Zerlate	2-100	Phygon	1-100
Parzate	2-100	Bioquin 1	1-100

Yield data were not taken in the New York test since no foliage diseases (leaf spots) were present. The data on yield and foliage condition at McGuffey, Ohio, are given in the following table. No disease appeared during the first two-thirds of the growth period but Cercospora infection then occurred and became quite serious on the untreated check by harvest time. Bordeaux mixture gave the best control in a 10-day application schedule, followed in effectiveness by Zerlate. All treatments gave a significant increase in yield with the exception of Phygon, which caused a mild form of foliage injury (Table 5).

Table 5. Influence of various fungicides on the control of carrot leaf spots and on yield at McGuffey, Ohio, in 1947

Treatments	Yield in Bu/Ac	Percent foliage dead at harvest
No treatment	30.9	85
Bordeaux 6-6-100	37.6	56
Zerlate 2-100	34.0	72
Parzate 2-100	36.3	76
Dithane Z 2-100	36.1	80
Phygon 1-100	30.6	84
Bioquin 1 1-100	35.2	76

Celery

Celery was sprayed by only three cooperators, -- J. W. Heuberger, Delaware; A. G. Newhall, New York; and J. D. Wilson, Ohio.

The materials under test were:

Bordeaux	8-8-100	Dithane Z	2-100
Tribasic	4-100	Mn ethylene bis	2-100
Zerlate	2-100	Phygon	1-100
Parzate	2-100	Bioquin 1	1-100

No data were obtained from the plots in Delaware or New York. Blight was present in the Delaware test but it was not possible to obtain yield data. Disease was scarce in the New York experiment, and this circumstance, together with the fact that the grower on whose farm the test was located inadvertently dusted the whole area with copper-lime dust about 3 weeks before harvest, made it undesirable to obtain data on yield or disease control.

Leaf blights were also scarce in the celery plots at McGuffey, Ohio. No late blight (Septoria) was present and infection by early blight (Cercospora) did not occur until only 2 or 3 weeks before harvest, and even then its development was mild and scattered. The plots were harvested, however, and the data are given in the accompanying table (Table 6).

Table 6. Yield and foliage condition of celery grown at McGuffey, Ohio, in 1947. Septoria leaf spot absent. Only a mild infection of Cercospora (early blight) was present.

Treatments		Yield in Tons/Acre	Foliage condition 2 weeks before harvest Percent functional
No treatment		22.2	80
Bordeaux	8-8-100	25.8	96
Zerlate	2-100	26.6	94
Parzate	2-100	25.8	86
Phygon	1-100	16.6	75
Dithane Z	2-100	22.7	80
Mn ethylene bis	2-100	23.7	88
Tribasic	4-100	24.2	89
Bioquin 1	1-100	25.9	90

Yield variations were small for most of the treatments, as would be expected in the absence of disease, unless some of the treatments were either phytotoxic or stimulatory. Phygon was somewhat injurious and the yield was consequently low, even lower than the untreated plots. The foliage condition seemed best on the plots treated with Bordeaux mixture, but those that received Zerlate, Parzate, Bioquin 1, and Tribasic were also in an excellent growth condition throughout the season.

CORNELL UNIVERSITY, ITHACA, NEW YORK

NATIONAL CUCURBIT FUNGICIDE TEST-1947

J. W. Heuberger

Twenty-two plant pathologists were approached, ten agreed to cooperate, and reports were received from the following eight cooperators:

C. E. Cox, Maryland
W. M. Epps, South Carolina
D. E. Ellis, North Carolina
E. F. Guba, Massachusetts
J. W. Heuberger, Delaware
C. J. Nusbaum, South Carolina
L. H. Person, Michigan
J. D. Wilson, Ohio

The test fungicides are listed below. Several cooperators also reported on other materials:

Bordeaux (6-3-100)
Compound A (3 1/3-100)
Fermate (2-100)
Zerlate (2-100)
Dithane Z-78 (2-100)
Compound A (7% Cu)
Fermate (10%)
Zerlate (10%)
Dithane Z-78 (6%)

The results are presented below for four crops.

Cantaloupes

Detailed reports were received from C. E. Cox (Maryland), C. J. Nusbaum (South Carolina), and J. W. Heuberger (Delaware). The table below was prepared from these reports. D. E. Ellis reported that Fermate caused injury in North Carolina, but no yields were taken as dry weather caused a crop failure; Fermate was also injurious in Delaware; L. H. Person, Michigan, reported that Bordeaux and Compound A caused marginal chlorosis, but no yields were taken as disease did not develop (Table 1).

There are two interesting features in the data, namely: (1) that Zerlate performed very well in all three locations as regards yield, even though its control of downy mildew was not as good as that of Bordeaux mixture, and (2) that Bordeaux mixture gave the highest yield in Maryland, where the intervals between spray applications were longer than in South Carolina and Delaware.

Cucumbers

Complete reports on downy mildew disease control and yield were received from W. M. Epps (South Carolina), D. E. Ellis, (North Carolina), and J. W. Heuberger (Delaware). Complete data are presented in Table 2.

Table 1. Effect of fungicidal sprays on the control of downy mildew and on the yield of cantaloupes (Hales Best Variety). 1947.

Material[a]	Concentration (lbs/gallons)	Percent Disease S.C.	Percent Disease Md.	Percent Disease Del.	Yield per acre (number) of fruits[b] S.C.	Md.		Del.
		6/23	8/7	8/12		M.	T.	
Untreated		100	74	100	3,456	2,142	7,696	7,792
Bordeaux	6-3-100	10	16	25	4,032	3,521*	10,091*	8,034
Compound A	3 1/3-100	18	41	38	5,544**	2,759	8,966	7,938
Fermate	2-100	55	44	55	4,392	2,686	9,547*	9,341**
Zerlate	2-100	40	44	35	6,408**	2,940*	9,474*	9,293*
Dithane Z-78	2-100	50	41	35	4,608*	2,976*	9,438*	8,809
LSD at 5% Point					970	792	1,343	1,152
LSD at 1% Point					1,329	--	--	1,549

[a] Spray dates--S. C. May 26, June 2, 9, 17, 25; Md. July 9, 16, 29, Aug. 7, 18. Del. July 1, 8, 15, 22, 29, Aug. 4, 11.

[b] S.C.--Marketable yield
Md. --M = 4.5" and larger; T = Total number
Del.--Marketable yield (+5" and -5")

* = Significant at 5% Point
** = Significant at 1% Point

Table 2. Effect of fungicidal sprays and dusts on the control of downy mildew disease and on the yield of cucumbers, 1947.

Materials[a]	Concentration (lbs./gals) Del.	Concentration (dust) S.C.&N.C.	% Disease[b] S.C. (M)	S.C. (P)	N.C.	Del.	Marketable yield per acre[c] S. C. (Bu) (M)	S. C. (Bu) (P)	N.C. (lbs.) (A & C)	Del. (lbs.) (N.P.)
Untreated			63	--	83	88	0	--	10,032	8,263
Bordeaux	6-3-100	--	--	--	--	25	--	--	--	10,804
Compound A	3 1/3-100	7% Cu	21	20	40	40	29.0	150.0	13,428*	10,819
Cuprocide	--	6% Cu	27	15	--	--	30.3	154.9	--	--
Tribasic	3-100	5% Cu	--	--	40	35	--	--	13,152*	13,194**
Tribasic + Zn	--	5%Cu + 3%Zn	--	--	43	--	--	--	13,928**	--
Fermate	2-100	10%	26	13	58	58	37.5	151.0	9,280	10,737
Zerlate	2-100	10%	25	10	60	40	39.9	198.4*	11,500	12,703*
Dithane Z-78	2-100	6%	31	30	54	40	20.6	124.9	12,356	14,125**
Parzate	2-100	6%	27	25	--	33	27.8	135.5	--	14,981**
LSD at 5% Point			9.6				NS	53.9	2,646	3,546
LSD at 1% Point			12.9						3,585	4,772

[a] Application: S. C. -- Aug. 21, 26, 30, Sept. 5, 10, 15, 20, 26,
dates : Oct. 2, 9
N. C. -- June 15, 23, 30, July 7, 14, 16
Del. -- July 1, 10, 18, 25, 31, Aug. 7

[b] N. C. data were given as percentage severity; the writer transferred them to percent disease to bring in line with other figures

[c] M = Marketer (mildew susceptible); P = Palmetto (mildew resistant); A & C = A & C variety; N. P. = National Pickling
Delaware data are for pickles.

Note for Table 2: Percentage of disease for Palmetto variety in South Carolina is due to a combination of mildew and fungicide injury. Copper compounds gave obvious injury. Most vigorous vines were from Zerlate. Dithane Z-78 dust "caked" in the humid climate of Charleston.

Bordeaux and Copper A gave obvious copper injury in Delaware; Tribasic was safer on the plants. Fermate caused some injury. Zerlate and Parzate gave the most vigorous vines in Delaware.

Table 3. Effect of fungicidal sprays on the control of downy mildew and anthracnose on Honeydew Melons, Blackville, South Carolina, 1947.[a]

Material	Concentration (lbs./gallons)	Percent diseased June 23	Percent defoliated				Fruits infected with anthracnose July 7
			June 26	July 2	July 7	July 12	
Untreated		84	25	75	100	dead	96
Bordeaux	6-3-100	29	0	15	80	dead	44
Compound A	3 1/3-100	34	2	30	85	dead	60
Copper 34	4-100	44	2	35	90	dead	56
Fermate	2-100	23	0	20	70	90	16
Zerlate	2-100	18	0	20	75	90	10
Dithane Z-78	2-100	28	3	30	90	95	19

[a] Planted April 5. Spray dates: May 26, June 2, 9, 17, 25. One or two additional applications should have been put on in July but it is questionable as to whether or not further spraying would have checked the destruction of the vines by anthracnose long enough to mature a marketable crop. Both anthracnose and downy mildew acted to defoliate the vines but anthracnose was the more aggressive disease of the two. Only three mature, marketable fruits were harvested from the entire experiment. The copper sprays caused marginal chlorosis on the leaves, Bordeaux and Compound A severely and Copper 34 moderately.

Table 4. Effect of fungicidal sprays on control of black rot (*Mycosphaerella citrullina*) and on yield of butternut squash, Waltham Field Station, Massachusetts 1947.

Material	Concentration (lbs./gallons)	Total number fruit[a]	Percent infected
Untreated		451	30.9
Fermate	2-100	620	3.2
Zerlate	2-100	602	1.7
Parzate	2-100	605	2.8
Dithane Z-78	2-100	584	13.6
Bordeaux	6-3-100	558	6.2
Compound A	3 1/3-100	537	6.9

[a] The yield figures indicate the degree of control of blossom rot (*Choanephora cucurbitarum*). The higher the yield the better the control.

Note (Table 4): Powdery mildew (Erysiphe cichoracearum) was very prevalent on the foliage of the untreated, Zerlate, and Dithane Z-78 plots. The other treatments gave good control.

It is obvious from the data in Table 2 that the organic fungicides do not control downy mildew as well as Bordeaux and some other copper compounds. However, except for possibly Fermate, they are less injurious to the plants than the copper compounds. The yield data from State to State are too variable to be compared, but they show that Tribasic bears watching and that Fermate was less satisfactory than Zerlate, Parzate, and Dithane Z-78; Zerlate was the top treatment in South Carolina, good in Delaware, but only fair in North Carolina. Parzate and Dithane Z-78 were the top treatments in Delaware but the poorest in South Carolina.

J. D. Wilson (Ohio) also submitted a report containing the following information: Zerlate, Fermate, and Dithane were less injurious than the coppers -- Parzate gave some injury, but not as severe as the coppers; Zerlate gave the highest yield, perhaps significantly better than the coppers, but not much better than the other organics. Results were complicated by insecticide injury.

C. E. Cox (Maryland) reported the following data on percentage defoliation -- Untreated, 74 percent; Dithane Z-78, 67 percent; Zerlate, 41 percent; Tribasic, 33 percent. These data were not statistically significant.

Honeydew Melons

A test was conducted by C. J. Nusbaum (South Carolina). The data are presented in Table 3.

These data are of particular significance as they show clearly that the organics (Zerlate, Fermate, Dithane Z-78) are far superior to the coppers for anthracnose control.

Butternut Squash

A power-spray test was conducted by E. F. Guba (Massachusetts). Six applications were made from July 23 to September 17. Data are presented in Table 4.

General Summary

The data obtained during the 1947 tests are not sufficiently extensive to draw general conclusions. It appears, however, that Zerlate has a definite place in the cucurbit disease control program, and that Parzate and Dithane Z-78 should be further evaluated. Except in a few instances, the yield response of plants treated with the dithiocarbamates has been very good.

As regards the control of specific diseases, the data show the following: (1) that the copper fungicides are somewhat better than the dithiocarbamate fungicides for the control of downy mildew disease and powdery mildew disease; (2) that the dithiocarbamate fungicides are better than the copper fungicides for the control of anthracnose disease on honeydew melons and the black rot and blossom rot diseases of squash.

UNIVERSITY OF DELAWARE, NEWARK, DELAWARE

COOPERATIVE TESTS OF FUNGICIDES FOR CONTROL OF DISEASES OF ORNAMENTAL PLANTS

A. W. Dimock

Snapdragon Rust

Cooperators: W. D. McClellan, U.S.D.A., Beltsville, Maryland; J. L. Forsberg, Illinois Natural History Survey, Urbana, Illinois; K. F. Baker, University of California, Los Angeles, California; H. A. Runnels, Ohio Agricultural Experiment Station, Wooster, Ohio; A. W. Dimock, Cornell University, Ithaca, New York.

Materials tested: The materials used, as indicated in the table, were those which had been recommended for snapdragon rust control in one region or another or had shown promise in preliminary tests. No attempt was made to evaluate a large number of the newer fungicides.

Planting stock and plot layouts: All plants were of the variety Afterglow raised locally from seed distributed from a single seed lot. Planted in field in uniform randomized block layout, 4 replicates per treatment, 15 to 25 plants per replicate.

Rating: Plants arbitrarily classified as follows: 0 = Healthy or trace; 1 = light, up to 10 infections per plant; 2 = moderate infection; 3 = severe infection, leaves, branches, or plants dead.

Results: Sufficient rust for reliable comparisons did not develop at Beltsville and Urbana. Data from Los Angeles, Wooster and Ithaca in following table:

Treatment	Average treatment rating		
	Ohio	California	New York
Check	1.71	2.96	3.00
Parzate 2#/100 gals.	0.00	0.58	0.35
Rosin lime-sulfur 2%	0.64	0.93	0.82
Fermate 2#/100 gals.	0.03	1.52	1.00
Wettable sulfur 3#/100 gals.	1.37	2.42	1.86
Bordeaux 8-8-100	0.17	2.45	2.97
	(8 applications)	(12 applications)	(9-10 applications)

DuPont Spreader-Sticker (1/1000) with all except rosin-lime-sulfur.

General comments:

1. Parzate gave excellent control at all localities.
2. Wettable sulfur failed in all localities.
3. Rosin lime-sulfur gave excellent control but was injurious under humid conditions of Wooster and Ithaca.
4. Fermate only moderately effective and Bordeaux ineffective with high disease potential, both very effective with moderate disease potential.
5. Under moist conditions at Ithaca, Bordeaux, though failing to control rust, prevented injury by controlling secondary invaders; under dry conditions at Los Angeles, Bordeaux-sprayed plants severely injured by dessication.

Septoria Leafspot of Chrysanthemums

Cooperators: McClellan, Forsberg, Runnels, Dimock.

Materials: Same as for snapdragon rust, except that Phygon at 2 lbs./100 gals. substituted for wettable sulfur.

Results: Disease developed adequately only at Ithaca, where all materials gave good control. Slight injury from Bordeaux noted at Wooster and Ithaca; severe injury from rosin lime-sulfur at Beltsville, Wooster and Ithaca; slight injury from Phygon at Ithaca.

Gladiolus Corm Treatments

Cooperators: McClellan, Forsberg, Runnels, Dimock, Ray Nelson, Michigan State College, East Lansing, Michigan, C. J. Gould, Western Washington Agricultural Experiment Station, Puyallup, Washington.

Materials tested: New Improved Ceresan, 1 lb./50 gals., 15 min.; Lysol, 1 qt./50 gals., 6 hrs.; Calogreen, 6 lb./50 gal., 5 min.; Arasan SF, 6 lb./50 gal., 5 min.; Parzate, 6 lb./50 gal., 5 min.; bismuth subsalicylate, 2 lb./50 gal., 5 min.; Dowicide 9B, 4 lb./50 gal., 3 hrs.; Puratized Agricultural Spray, 1:10,000 active, 15 min.

Planting Stock: In all but one case, locally obtained #5 Picardy corms were used. A uniform randomized block layout was employed with 100 to 150 corms in each of 4 replicates for each treatment.

Results: While differences in results due to soil and climate were anticipated, the use of different planting stocks in each locality introduced a variable which made any comparison of results out of the question, and no general conclusions could be drawn. It was apparent that for tests of this type to be significant the planting stock should all come from a single collection. The data collected in this season's tests are being circulated to the different cooperators.

CORNELL UNIVERSITY, ITHACA, NEW YORK

SUMMARY OF DATA FROM NATIONAL COOPERATIVE POTATO SPRAY FUNGICIDE EXPERIMENT

W. F. Buchholtz

Contributors of data, by States:

Maine................	Reiner Bonde
Connecticut..........	Saul Rich
Rhode Island.........	John B. Rowell
New York.............	Robert C. Cetas
Pennsylvania.........	H. W. Thurston, Jr.
Ohio.................	J. D. Wilson
Delaware.............	J. W. Heuberger
New Jersey...........	John C. Campbell
Indiana..............	R. W. Samson
Michigan.............	J. H. Muncie
Iowa.................	W. J. Hooker
Minnesota............	Carl J. Eide
South Dakota.........	C. M. Nagel
North Dakota.........	Wm. G. Hoyman
Summary compiled by..	W. F. Buchholtz

PLAN OF THE EXPERIMENT

Spray Treatments

1. Check, no fungicide..........	
2. Bordeaux....................	8-8-100
3. Copper oxychloride sulphate..	4-100
4. Dithane D-14 + zinc sulphate + lime......................	4-1-1/2-100
5. Parzate......................	2-100
6. Zerlate......................	2-100
7. Phygon.......................	1-100

DDT, 50%, 1 1/2 lb.-100, included in all fungicide sprays, and applied alone to all no fungicide check plots.

SPRAY MATERIALS were supplied by the manufacturer, to all cooperators from one batch of each material. All were used without added spreaders or stickers.

SPRAY EQUIPMENT was that available to individual experimenters. PRESSURES and DOSAGES were those effected by the equipment available.

PLOT SIZE varied; 50 feet of row was suggested. Four to six REPLICATIONS were most commonly used.

VARIETY and CULTURAL PRACTICES were those locally adapted and used.

DEFOLIATION PERCENTAGES were estimated after the method of Horsfall and Barratt. Total YIELDS were determined at harvest time.

Selection of spray materials and planning of the experiment were undertaken after all prospective cooperators had been consulted by correspondence.

The following major objectives and prerogatives of the experiment should be kept in mind:

1. The overall committee was charged with evaluating the "newer organic fungicides".

2. To determine locally adapted fungicide spray or dusting programs is a local problem, not a feasible immediate objective of such a cooperative effort.

3. To be accepted and successful, it was deemed necessary to keep the experiment relatively small.

RESULTS

Table 1 contains information descriptive of the 21 individual experiments in 14 States. Each experiment is listed by number, according to location and State. In all succeeding tables, numbers at tops of columns refer to experiment numbers so listed in table 1. Experiments 1 to 9, inclusive, are those in which late blight was present in considerable abundance. In experiment 10 to 21, inclusive, late blight was absent or present in amounts insufficient to affect the experiment. All succeeding tables are arranged according to this grouping of the experiments.

Tables 2 and 3 list mean total yields and percentages of defoliation, if submitted, by treatments for all experiments, those with late blight in table 2, those without late blight in table 3. Treatments are not listed in table 3, but treatment order is the same as in table 2. Minimum significant differences (M.S.D.) at the 5 percent level are listed for each experiment unless mean differences were not significant (N.S.)

Tables 4 and 5 list the yield ranks of treatments by experiments, those with late blight in table 4, those without late blight in table 5. Ranks of spray treatments which were lower in yield than the checks are underlined, except for the Michigan experiment (17), in which lack of spray wheel damage caused the checks to be highest in yield.

It is evident that in the 9 experiments with late blight, (table 4), Parzate, Dithane, CCCS and Bordeaux all ranked high in yield. In Maine, late blight was severe, but late; the Maine results tend to lower unduly the average yield rank of Bordeaux and perhaps similarly raise the yield rank of Zerlate.

Dithane, Parzate and Zerlate are high in yield rank in the 12 experiments without late blight (table 5).

Phygon is low in yield rank in both table 4 and table 5.

Tables 6 and 7 list the defoliation ranks of treatments, by experiments, those with late blight in table 6, those without late blight in table 7. Defoliation estimates were not submitted for some experiments; in some there was no defoliation. Average yield ranks for the experiments for which defoliation estimates were available are listed alongside average defoliation ranks. Also listed in tables 6 and 7 are average yield ranks for all experiments, as they appear in the right hand column of tables 4 and 5.

It is evident that average ranks of treatments by defoliation are similar to ranks by yields for the same treatments. A notable exception is Bordeaux in the experiments without late blight (table 7). Its average yield rank is low, comparable to that of the unsprayed check, whereas its average defoliation rank is considerably higher. While not so striking as in table 7, the same tendency for Bordeaux to rank lower in yield than in defoliation comparisons is evident in table 6, compiled from experiments in which late blight was present.

However, the copper-containing sprays, Bordeaux and COCS were ranked relatively better by both yield and defoliation comparisons in experiments with late blight present (table 6) than in experiments with late blight absent (table 7). Bordeaux was the only treatment which provided adequate control of the severe late blight which prevailed in three experiments in two States (New York, 4; Ohio, 7, 8).

Stimulation by the organics, particularly those containing zinc, was suggested by contributors of data in three States, Minnesota, North Dakota and New Jersey.

Brief statements concerning the various experiments, submitted by cooperators with their data, are presented, by States, after table 7.

Table 1. Location, diseases present, number and dates of sprays, variety, and planting and harvest dates for the 21 experiments in 14 States.

	State, Location	Diseases Present			Sprays		Variety	Planting date	Harvest date
		Late Blight	Early Blight	Others	No.	Dates			
1.	Maine, Presque Isle	heavy	+		7	7/14-9/11	Katahdin	5/25	9/27-29
2.	Connecticut, Mt. Carmel	+			10	7/19-9/18	Katahdin	6/11	11/3
3.	Rhode Island, Kingston	heavy	heavy		10	6/30-9/4	Green Mountain	4/24	10/9
4.	New York, eastern	heavy	heavy	Botrytis blight	11	6/10-8/19	Green Mountain	3/23,24	9/3-18
5.	Pennsylvania,	heavy	+		10	7/1-9/11	Katahdin	5/25	10/5,6
6.	State College	heavy	+		10	7/1-9/11	Rural Russet	5/25	10/3,4
	Ohio,								
7.	Wooster	severe	tr		7	7/18-9/18	Katahdin	6/13	10/15
8.	Wooster	severe	tr		7	7/18-9/19	Katahdin	6/15	10/16
9.	McGuffey	abund.	severe		7	6/27-8/25	Cobbler	5/20	10/1,2
10.	Wooster	moder.	severe		7	6/10-8/7	Cobbler	5/12	9/5
11.	Marietta	tr.	+		6	6/10-7/30	Cobbler	5/1	8/24
12.	Delaware, Georgetown	+	+		6	8/4-9/30	Dakota Red	6/20	10/19
13.	New Jersey Cranbury	tr.	-		8	6/11-8/11	Katahdin	4/29	9/29,30

State, Location	Diseases Present			Sprays		Variety	Planting date	Harvest date
	Late blight	Early blight	Others	No.	Dates			
Indiana,								
14. Lafayette	-	tr		4	6/3-7/15	Cobbler	4/15	8/9
15. Newland	-	+		5	7/3-8/18	Katahdin	5/30	9/24
16. Newland	-	+		5	7/3-8/18	Chippewa	5/30	9/24
17. Michigan, Lake City	-	+		7	7/15-9/15	Menominee	6/10	9/30-10/3
18. Iowa, Crystal Lake	-	severe		4	7/15-8/30	Cobbler	5/14	9/25
19. Minnesota, Crookston	tr	tr		7	7/14-9/12	Chippewa	6/20	9/23
20. South Dakota, Brookings	-	+		3	8/12-9/12	Bliss Triumph	5/20	10/25
21. North Dakota, Grand Forks	-	+		6	7/15-9/4	Bliss Triumph	5/15	10/8

Table 2. Yields and percentages of defoliation in potato spray plots in 9 similar experiments in 6 northeastern States (late blight present in these experiments).

	1	2	3	4	5	6	7	8	9
	Maine	Connecticut	Rhode Island	New York	Pennsylvania		Ohio		
							Wooster	Wooster	McGuffey
Check	538	283	344	287	318	243	288	263	644
	Dead	10	100	96		95	69	90	82
Bordeaux	528	356	473	393	363	315	440	324	815
	44	4	34	48		3	49	32	61
COCS	582	364		341	381	321	415	314	777
	50	2 1/2		68		5 1/2	45	45	66
Dithane	593	362	528	342	352	341	393	311	854
	46	1	48	89		4	49	47	49
Parzate	599	348	560	360	374	339	419	340	856
	40	4	18	67		4	32	42	34
Zerlate	600	300	486	339	375	284	402	306	806
	55	3	77	97		90	49	57	42
Phygon	542	347	447	331	330	266	398	288	790
	52	3 1/2	57	58		58	42	52	56
M.S.D.	37	42	28	52	41	19	33	27	73

Table 3. Yields and percentages of defoliation in potato spray plots in 12 similar experiments in 9 eastern and midwestern States (late blight absent from these experiments).

10	11	12	13	14	15	16	17	18	19	21	22
Ohio		Delaware	New Jersey	Indiana			Michigan	Iowa	Minnesota	South Dakota	North Dakota
Wooster	Marietta			Lafayette	Newland						
354 98	365 86	52 100	403	162	372	402	248 36	121 65	119	197 95	257 94
445 54	491 50	77 53	405	160	339	417	192 3	112 33	121	209 95	269 81
438 75	466 52	79 70	385	160	322	379	204 12	127 44	122	239 92	273 88
465 51	540 39	91 58	464	161	398	406	217 4	141 26	127	246 82	289 72
461 51	452 62	104 23	433	170	348	361	233 6	140 24	131	241 81	279 75
459 54	545 39	77 60	431	172	384	397	203 7	122 31	124	250 86	284 72
470 80	460 72	52 80	404	163	324	357	201 12	114 54	125	218 85	272 84
50	52	28	33	9	N.S.	N.S.	N.S.	22	N.S.	35	24

Table 4. Rank of treatments, by yield, in 9 experiments in 6 northeastern States (late blight present in these experiments).

	1	2	3	4	5	6	7	8	9	
	Maine	Conn.	R. I.	N. Y.	Penn.		Ohio			Ave.
Check	6	7	6	7	7	7	7	7	7	6.8
Bordeaux	7	3	4	1	4	4	1	2	3	3.2
COCS	4	1		4	1	3	3	3	6	3.1
Dithane	3	2	2	3	5	1	6	4	2	3.1
Parzate	2	4	1	2	3	2	2	1	1	2.0
Zerlate	1	6	3	5	2	5	4	5	4	3.9
Phygon	5	5	5	6	6	6	5	6	5	5.4

Table 5. Rank of treatments, by yield, in 12 experiments in 9 eastern and midwestern States (late blight absent from these experiments).

	10	11	12	13	14	15	16	17	18	19	20	21	
	Ohio		Dela.	N.J.	Indiana			Mich.	Iowa	Minn.	S.D.	N.D.	Ave.
Check	7	7	6	6	4	3	3	1	5	7	7	7	5.3
Bordeaux	5	3	5	4	6	5	1	7	7	6	6	6	5.1
COCS	6	4	3	7	6	7	5	4	3	5	4	4	4.8
Dithane	2	2	2	1	5	1	2	3	1	2	2	1	2.0
Parzate	3	6	1	2	2	4	6	2	2	1	3	3	2.9
Zerlate	4	1	4	3	1	2	4	5	4	4	1	2	2.9
Phygon	1	5	6	5	3	6	7	6	6	3	5	5	4.8

Table 6. Rank of treatments, by percentage of defoliation, in 7 experiments in 6 northeastern States (late blight present in these experiments). Yield ranks in the same 7 experiments and in all 9 experiments are listed for comparison.

	1	2	3	4	6	8	9		Yield	Yield
	Maine	Conn.	R.I.	N.Y.	Penn.	Ohio		Ave.	rank (7)	rank (9)
Check	7	7	6	7	7	7	7	6.7	6.7	6.8
Bordeaux	2	5	2	3	1	1	5	2.7	3.4	3.2
COCS	4	2		6	4	3	6	4.2	3.0	3.1
Dithane	3	1	3	2	2	4	3	2.6	2.4	3.1
Parzate	1	5	1	5	2	2	1	2.4	1.9	2.0
Zerlate	6	3	5	1	6	6	2	4.1	4.1	3.9
Phygon	5	4	4	4	5	5	4	4.4	5.4	5.4

Table 7. Rank of treatments, by percentage of defoliation, in 7 experiments in 6 eastern and midwestern States (late blight absent from these experiments). Yield ranks in the same 7 experiments and in all 12 experiments are listed for comparison.

	10	11	12	17	18	20	21		Yield	Yield
	Ohio		Dela.	Mich.	Iowa	S.D.	N.D.	Ave.	rank (7)	rank (12)
Check	7	7	7	7	7	6	7	6.9	5.7	5.3
Bordeaux	3	3	2	1	4	6	4	3.3	5.6	5.1
COCS	5	4	5	5	5	5	6	5.0	4.0	4.8
Dithane	1	1	3	2	2	2	1	1.7	1.9	2.0
Parzate	1	5	1	3	1	1	3	2.1	3.0	2.9
Zerlate	3	1	4	4	3	4	1	2.9	3.0	2.9
Phygon	6	6	6	5	6	3	5	5.3	4.9	4.8

Brief statements by contributors of data:

MAINE - Crop very late; killing frost September 20 prevented greater differences between treatments. Late blight severe, but late.

CONNECTICUT - Late blight very light; stopped September 13. All spray treatments but Zerlate significantly above check in yield.

RHODE ISLAND - Late blight severe late July until August 28; then early blight severe. Parzate, Dithane high in yield; Parzate, Bordeaux best prevented defoliation. Bordeaux apparently suppressed yield through injury. Phygon controlled late blight, not early blight.

NEW YORK - Early and late blight severe after July 20. Bordeaux gave adequate control, Parzate promising. Dithane inadequate for severe late blight control when applied weekly. Phygon controlled late blight, but gave low yield. Zerlate failed to control late blight. COCS not equal to Bordeaux.

PENNSYLVANIA - Late blight first found July 21; no spread for 3 weeks; heavy by September 16. Alternaria present but never serious.

OHIO - Early blight only on early potatoes at Marietta and Wooster. Late blight on muck at McGuffey. Late blight was late but severe on late-planted Katahdins at Wooster. Bordeaux and Parzate slowed it down but in general a 10-day schedule of organics didn't hold late blight at Wooster.

DELAWARE - September 30 defoliation due entirely to early blight. Copper plots, particularily Bordeaux, had more frost damage than organic plots. No late blight present.

NEW JERSEY - Practically no disease present in check plots. Organic fungicides definitely superior to coppers in ability to increase yields. Insect populations during season similar in all plots. Looks like yield stimulation by organics. (Dithane, Parzate, Zerlate - W.F.B.)

INDIANA - Rainfall was very deficient. No late blight developed. Abundant early blight just before frost. No fungicide outstanding. Perhaps Bordeaux depressed yields slightly.

MICHIGAN - No late blight. Early blight increased rapidly after September 5. Killing frost September 24. Irrigated 4 times.

IOWA - Early blight abundant by August 20. Bordeaux, Dithane, Parzate and Zerlate seemed to control it; Phygon and COCS did not. Dithane and Parzate high in yield. Bordeaux low.

MINNESOTA - Only traces of late and early blight when vines killed by frost September 22. Increases in vine weight (September 18, 19) indicates zinc had stimulatory effect in absence of disease.

SOUTH DAKOTA - Disease this year was early blight; it appeared quite late. Defoliation and yield differences apparent but not striking.

NORTH DAKOTA - Dithane and Zerlate plots highest in yield and early blight control. Copper sprays or dusts not very effective in controlling early blight. Zinc seems beneficial in the Valley.

IOWA STATE COLLEGE, AMES

REPORT OF THE SECTION ON FUNGICIDE TESTS ON THE STONE AND SMALL FRUITS

H. F. Winter

Introduction

On the basis of answers to a questionnaire sent to interested workers in the field of fungicide testing on stone and small fruits, five funicide treatments were selected for use on each of three fruit crops, namely, peaches, cherries, and grapes. When the results came in at the close of the season, it was found that most of the cooperators could not adhere very closely to the five treatment program. Consequently, the data submitted did not lend itself well to the formation of any sort of summary table. This report therefore consists of individual reports by cooperators in their various States, and a brief summary statement for each of the three fruit crops involved. The data submitted are those of the cooperators named.

The cooperation and effort and good will extended by those taking part in this project are appreciated.

Contributors of Data, by States

Delaware............	Spencer H. Davis
Michigan............	Donald Cation, John Vaughn
Illinois............	Dwight Powell
New York............	J. M. Hamilton, Alvin J. Braun
New Hampshire.......	M. C. Richards
Oklahoma............	G. J. Gray, W. R. Kays, W. W. Ray
Ohio................	H. F. Winter, H. C. Young
West Virginia.......	C. F. Taylor
Wisconsin...........	G. W. Keitt, J. Duain Moore

Peach

Table 1. Cooperative fungicide test on peaches, Hale Haven Variety at Milton, Delaware. Spencer H. Davis -- 1947

Treatment (lbs per 100 gal.)	Percentage Brown Rot at harvest
Check	35.3
Sulforon - Zinc sulfate - Lime 6-8-8	18.4
Zerlate - Lime 2-3	22.7
Fermate 2	21.2
Parzate - lime 2-3	21.2
Parzate 50%, Zerlate 50% - Lime 2-3.	15.9
Parzate 50%, Fermate 50% 2	18.5
Zinc-8-Quinolinolate - Lime 1-2	30.8
Phygon - S.S. 3/4 - 1 pt.	29.7
L.M.S.D 5% point	19.24*

Spray dates: 5/21, 6/3, 6/16, 6/26, 7/7, 7/17, 7/28.

Fruit counts made 8/7. Harvest on 8/8.

Comments:

1. Arsenical injury observed on Fermate, Parzate-Fermate, Parzate, Zerlate, and Parzate-Zerlate plots.
2. Zinc-8-Quinolinolate impossible to get into complete suspension.

Table 2. Cooperative fungicide test on peaches in Michigan. -- Donald Cation and John Vaughn -- 1947

Treatment[a] (lbs. per 100 gals.)	Percentage Brown Rot (after storage)[b]
Magnetic "70" paste (2 applications) L.L.S. 1 qt. (last application)	55.5
Zerlate 1 1/2	68.0
Wettable sulfur (3M) 5	69.0
Phygon 1	75.0
Parzate 1 1/2	79.0
Zinc-8-Quinolinolate 1	87.0
Check (no fungicide)	89.5

[a] Trees sprayed three times beginning one month before harvest. Last spray applied 8 days before harvest.

[b] Fruits were picked in clean baskets and stored at low temperature for two days and at room temperature for 4 days before counting.

Table 3. Cooperative fungicide test on peaches[a], Southhaven Variety at Wooster, Ohio. -- H. F. Winter and H. C. Young -- 1947

Treatment[b] (lbs. per 100 gals.)	Brown Rot (at harvest) Percent	Angle
Micronized sulfur 6	10.94	18.72
Magnetic "70" paste[c]........	8.56	16.60
Flotation paste 8[c]..........	12.94	20.38
Zerlate 2....................	5.76	13.48
Phygon 1/2...................	7.60	15.82
Zinc-8-Quinolinolate 1......	8.88	17.27
Zinc-8-Quinolinolate 1/2....	16.86	23.54
Magnetic "70" paste 8[d]......	7.30	14.94
Magnetic "70" paste 8[d]......	9.19	17.26
Check (No fungicide)........	21.28	27.15

L.S.M.D. 5% level = 5.490 angles
L.S.M.D. 1% level = 7.340 angles

[a] Single tree plots replicated 6 times.

[b] Sprays applied as follows: Shuck Fall 5/27, 1st cover 6/12, 2nd cover 7/28, 3rd cover 8/11, preharvest 8/23. Harvest started 8/27.

[c] In addition to above, a pink spray was applied.

[d] Fungicide omitted from shuck-fall application.

Table 4. Cooperative fungicide test on peaches in Illinois. -- Dwight Powell -- 1947

	Percentage Brown Rot			
	At harvest		After storage	
Treatment (lbs. per 100 gallons)	Georgia Bell	Hale-haven	Georgia Bell	Hale-haven
Bioquin "100" 1.......................	0.6	0.5	55.0	53.0
Bioquin "100" 3/4.....................	1.4	1.7	70.0	86.0
Bioquin "100" 1/2.....................	1.8	2.0	60.0	23.0
Bioquin "100" 1/4.....................	4.0	0.7	48.0	62.0
Zerlate-Sulfur 1/4-3..................	1.7	0.3	42.0	14.0
Bioquin "100" 50%, Pyrax 50% 1.......	0.6	1.5	41.0	46.0
Bioquin "100" 50%, Bentonite 50% 1...	0.5	0.7	50.0	28.0
Bioquin "100" - Sulfur 1/4-3.........	1.5	0.9	54.0	32.0
Sulfur 6..............................	1.4	1.1	49.0	33.0
Bioquin "1" 1/4......................	1.0	0.4	32.0	62.0
Bioquin "1" - Sulfur 1/4-3..........	0.9	0.6	30.0	20.0
Bioquin "1" 50%, Florigel 50% 1......	1.5	0.1	25.0	34.0
Bioquin "1" 50%, Florigel 50% 1/4....	1.0	0.2	28.0	33.0
Zerlate 1/2..........................	0.6	0.4	50.0	50.0
Zerlate 1/4..........................	1.0	0.4	52.0	22.0
Check (no fungicide)................	2.5	0.6	65.0	44.0

Summary Statement of Peach Fungicide Test.

The most striking single fact emerging from a study of the results of this cooperative test is that none of the materials tested really controlled brown rot (Monilinia fructicola] under the apparently widespread favorable conditions for disease development during 1947. This was particularly true when rot counts were made after a short storage period. It is interesting to note that in several cases harvest records indicated little damage from rot, but that in the same tests rot developed rapidly in storage. Apparently there is a particular need for better timing of fungicide application and perhaps better materials for the control of after-harvest rot.

While it was difficult to evaluate the materials from the results submitted, it seems fairly obvious that none of the new organic fungicides demonstrated their superiority over the best inorganic sulfur materials. However, from the results given, it appears that Zerlate and Bioquin "1" alone, and in combination with other materials, especially sulfur, are worthy of further trial.

Cherry

Table 5. Fungicide test for control of cherry leaf spot in West Virginia. -- C. F. Taylor -- 1947

Treatment (lbs. per 100 gal.)[a]	Leaves retained (%) 7/25	8/27	10/10
Tenn. "26" - lime 3-3	91.8	83.5	41.0
C.O.C.S. - lime 1 1/2-3	94.7	78.1	7.6
Bordeaux 1-3-100	92.5	81.1	21.8
Phygon 1[b]	56.9	21.9	0.4
341-C 1 qt. (1st 2 sprays)[b]	92.7		
341-B 1 1/2 lb. (last 3 sprays)		18.9	0.6
Check[c]	13.5	2.2	0.0
L.S.M.D. (5% level)[d]	6.07	15.4	16.01
L.S.M.D. (1% level)	8.46	21.21	22.04

[a] Treatments applied 5/7, 5/20/ 5/31, 6/18, 7/12.

[b] 3 lbs. lime added to sprays applied 5/20 and 5/31. 1/2 lb. lime added to 341-C spray 5/7.

[c] Sprayed with Phygon 6/18 and Ten "26" 7/12

[d] Check tree data omitted from statistical treatment of foliage data.

Comments:

Difference in size of fruit with different treatments was not significant.

Of the copper materials used Bordeaux 1-3-100 caused "copper ring" type injury to 26.0% of fruits, C.O.C.S.-lime 3-3 caused 22.2% and Tenn. "26"-lime 3-3 caused 16.6% injury. None of this type injury was evident when Phygon and 341 were used.

Table 6. Fungicide test for cherry leaf spot control at Stillwater, Oklahoma. G. F. Gray, W. R. Kays, and W. W. Ray -- 1947

Treatment (lbs. per 100 gal.)[a]	% Leaves retained Aug. 28	
	Large trees	Small trees
Bordeaux 1-2-100	97.87	77.22
Tenn. Tribasic (53%) - lime 1 1/2-5	98.43	98.44
Dodge Tribasic (53%) - lime 1 1/2-5	99.17	90.36
Fermate 1	97.94	93.05
Tenn. Tribasic 7% dust	--	73.99
Dodge " 7% dust	--	95.75
Fermate 10% dust	--	98.74
Check	94.41	74.27

[a] Dates of spray application: Petal fall 5/2, Shuck fall 5/9, Post harvest 6/24.

Table 7. Fungicide test for cherry leaf spot control at Egg Harbor, Wisconsin. J. Duain Moore -- 1947.

Treatment (lbs. per 100 gallons[a]	Leaves retained[b] %	Average no. lesions per leaf on foliage remaining	Increase or decrease in fruit size %
Bordeaux 6-8-100 (1) 3-4-100 (2,2A,3)	97.9	0.12	Standard
" 6-8-100 (1,2,3)	97.1	0.20	+5.3
Tenn. "26"-lime-orthex 3-3-1 pt. (1,2,2a) Bordeaux 3-4-100 (3)	98.1	0.31	+3.2
Tenn. "34"-lime-orthex 3-3-1 pt. (1,2,2A) Bordeaux 3-4-100 (3)	98.6	0.12	+3.9
Fermate-lime 1 1/2-1 1/2 (1,2,2A) Bordeaux 3-4-100 (3)	98.8	0.12	+5.0
Compound 341-B 3(1,2,2A) Bordeaux 3-4-100(3)	98.2	0.36	+4.7
C.O.C.S.-lime 1 1/2-3 (1,2,2A) Bordeaux 3-4-100 (3)	98.0	0.25	+0.7
Phygon 1 (1,2,2A) Bordeaux 3-4-100 (3)	97.7	0.15	+8.5
Bordeaux 6-8-100 (1) Tenn. "34"-lime-Dowax 3-3-1 (2,2A) Bordeaux 3-4-100 (3)	98.1	0.35	+9.2
Check (No fungicide)	35.0	46.22	--

[a] Dates of spray application (1) June 12; (2) June 25; (2A) July 8; (3) Aug. 12. Lead arsenate added 2-100 in (1,2)

[b] Data taken on 300 leaves per tree.

Table 8. Cherry leaf spot fungicide test at Clyde, Ohio. H. C. Young and H. F. Winter -- 1947.

Materials in 100 gallon water (lbs.)	Leaves retained Sept. 25 Percent
Bordeaux 1 1/2-3-100	40.0
" 1-2-100	60.0
C.O.C.S. - Lime 1 1/2-3	95.0
Tenn. "26" - Lime 3-3-	95.0
Tenn. "26" - Lime 2-2 + liquid Orthex 1 pint	95.0
C.O.C.S. - Lime 1-2 + liquid Orthex 1 pint	95.0
Phygon 1 lb.	65.0
Compound 341 - "A" 2 1/2 lb. + Lime 3 lb.	20.0
" 341 - "B" 3 lb. + Lime 3 lb.	25.0
" 341 - "C" 1 qt. + Lime 3 lb.	85.0
Bioquin "1" 1/2 lb.	50.0

Spray dates -- May 28th, June 9th, June 24th, July 7th, and July 25th.

Comments:

1. Leaf loss in Bordeaux treatments due largely to injury.
2. Compound 341-C caused only trace of fruit injury.

Table 9. Fungicide test for cherry leaf spot control at Geneva, New York. J. M. Hamilton -- 1947.

Treatment (lbs. per 100 gallons)[a]	Percentage leaves retained Sept. 4	Oct. 3
C.O.C.S. - Lime 1 1/2-3	91.8	55.6
Fermate 1 1/2	96.1	61.3
Phygon - Lime 1-2	65.0	0.0
341-B - Lime 3-2	63.4	0.0
Micronized sulfur - Lime - Orthex 5-2-1 pt.	28.2	0.0
341-B - Lime 1-2	47.8	0.0
341-C - Lime 1 pt.-2	55.1	0.0
341-C - Lime 1 qt.-2	91.4	64.5
Cupro K - Lime 3-3	94.2	59.2
Cupro K - Lime - Orthex 3-3-1 pt.	94.3	82.2
Tenn. "26" - Lime 3-3	97.0	89.7
Bordeaux 1 1/2-6-100 + M.S. 1	98.2	96.0
C.O.C.S. - Lime - Orthex 1 1/2-3-1 pt.	97.5	80.5

[a] Spray dates 5/24, 6/2, 6/13, 6/27, 7/30. All treatments sprayed with Bordeaux 1-3-100 on May 24. Differential treatments started June 2.

Comments:

1. Fixed coppers apparently superior to organics and sulfur.
2. Fermate was excellent early, but did not hold through postharvest period. Breakdown suggested.
3. Tenn. "26" gave best control and has greater retention than C.O.C.S. or Cupro K.
4. Addition of Orthex improved retention of C.O.C.S. and Cupro-K.
5. 341-B apparently was lacking in retention.

Summary Statement of Cherry Fungicide Test.

The test herein reported concerns the cooperative testing of fungicides for the control of one disease, namely, cherry leaf spot [Coccomyces hiemalis]. Results have been submitted for tests conducted in five States. The original five-fungicide program again was not closely followed, but the reports are nevertheless interesting.

In general, the fixed copper materials with lime have controlled leaf spot better than the organics. Of the fixed coppers tested Tenn. "26" was better in two trials and equal to C.O.C.S. in two others. Bordeaux 1-2-100 and 1 1/2-3-100 were somewhat inferior to the fixed coppers. Phygon has apparently controlled leaf spot well in the early summer, but failed to hold the disease later in the season. Fermate is in somewhat the same category, but when a copper was used in post-harvest results were excellent. Compounds 341 A and 341 B have failed to satisfactorily control leaf spot. Compound 341 C proved superior to the other formulations of 341, but some fruit injury was reported.

Grape

Table 10. Fungicide test for grape black rot control in New York.
Alvin J. Braun — 1947.

Treatment (lbs. per 100 gal.)	Berries rotted (percent) Branchport[d]	Tivoli[e]
Fermate[a] 1	1.0	1.3
Fermate[a] 2	0.1	0.2
Bordeaux[b] 4-4-100	0.2 (S.I.)[c]	15.6 (S.I.)[c]
Bordeaux[b] 8-8-100	0.2 (S.I.)[c]	10.2 (S.I.)[c]
Zerlate[a] 2	1.3 (S.I.)[c]	--
Check (No fungicide)	28.8	72.2
L.S.M.D. (5% level)	6.5	3.9
" (1% level)	9.1	5.5

Variety -- Concord

[a] Dupont spreader-sticker added -- 4 oz/100 gal. in pre-bloom, 8 oz/100 gal. in later sprays.
[b] Rosin fish oil soap added -- 1 lb/100 gal in pre-bloom, 2 lb/100 gal. in later sprays.
[c] S.I. -- Moderate to severe spray injury developed in August.
[d] Spray schedule -- Shoots 8-12 inches 6/7, immediately before bloom 6/23, after bloom 6/30, 7/10, and 7/21.
[e] Spray schedule -- Before bloom 6/12, after bloom 6/25, and 7/11.

Table 11. Grape black rot fungicide test at Avon, Ohio. H. F. Winter -- 1947.

Materials in 100 gallons water	Black Rot (Berries Rotted) Percent	Angles
Bordeaux 4-6-100 (1st 3 sprays)		
" 2-3-100 (4th spray)	7.94	16.28
Tenn. "26" 4 lb, lime 4 lbs. (1st 3 sprays)		
" "26" 2 lb, " 2 lbs. (4th spray)	11.54	19.68
C.O.C.S. 2 lbs, lime 4 lbs. (1st 3 sprays)		
" 1 lb., " 2 lbs. (4th spray)	14.12	21.70
Fermate 2 lbs	0.15	1.98
Zerlate 2 lbs	0.47	3.86
Fermate 2 lbs. (1st 3 sprays)		
Tenn. "26" 2 lb., lime 2 lbs. (4th spray)	1.04	5.16
Fermate 2 lbs., Goodrite P.E.P.S. 1/2 lb.	0.10	1.45
Phygon 1 lb. (1st 2 sprays)		
" 3/4 lb. (3rd spray)		
" 1/2 lb. (4th spray)	2.62	9.06
Check (no fungicide)	25.76	

Spray dates -- May 26th, June 10th, July 2nd, and July 23rd.

L.S.M.D. (In angles) -- .05 level = 3.1345
.01 level = 4.1939

Summary Statement of Grape Fungicide Test.

Data are submitted for fungicide trials for the control of grape black rot [Guignardia bidwellii] in two States, New York and Ohio. Very limited reports were received also from Oklahoma and New Hampshire, but were of such nature that tables of results could not well be devised.

In brief, Fermate demonstrated its superiority over Bordeaux and the fixed coppers for black rot control. This was also found to be true in the report submitted by M. C. Richards from New Hampshire. Zerlate controlled the disease well, but caused injury in the New York test. Phygon was inferior to Fermate for control and caused fruit spotting in Ohio.

Since Fermate controls black rot so well, but is ineffective against mildew, a split schedule of Fermate and copper is suggested for further trials.

OHIO AGRICULTURAL EXPERIMENT STATION, WOOSTER

SUMMARY OF 1947 COOPERATIVE TOMATO FUNGICIDE EXPERIMENTS

M. B. Linn and J. D. Wilson

The following states and cooperators submitted data in time for inclusion in this report:

Connecticut - Saul Rich
Delaware - J. W. Heuberger
Illinois - M. B. Linn
Iowa - W. F. Buchholtz
Maryland - C. E. Cox
Michigan - M. C. Strong
Minnesota - C. J. Eide
New Jersey (a) - B. H. Davis
New Jersey (b) - S. G. Younkin
New York - W. T. Schroeder
North Dakota - W. E. Brentzel
Ohio (4 tests) - J. D. Wilson
Pennsylvania (2 tests) - W. S. Beach
South Carolina - W. M. Epps[1]
South Dakota - C. M. Nagel

Experiments planned by R. W. Samson (Indiana), C. M. Tucker and R. A. Schroeder (Missouri) were ruined by early-season rainfall.

Five fungicides or treatments chosen by the cooperators were used in all tests. These materials -- numbered 1 to 5 below -- and optional treatments (abbreviations in parentheses adopted for tabulation) are:

1. Phygon (Ph) 1-100
2. Dithane Z-78(78) 2-100
3. Tribasic copper sulfate (Tr) 4-100
4. Zerlate (Z) 2-100
5. Zerlate alternating with Tribasic (Z-T)
6. Untreated check (Ck)
7. Bordeaux mixture (Bo) 8-8-100
8. Parzate (Par) 2-100
9. Yellow Cuprocide (YC) 2.4-100
10. Bioquin 1 (Bio) 1-100
11. Zerlate (3 appl.) followed by Tribasic (2 appl.) (Z-T$_1$)
12. Zerlate-Parzate mixture at 1:1 (Z-P) 2-100 ?
13. Zerlate alternating with Bordeaux or Z-Z-B-Z-B (Z-B)
14. Same as No. 13 but Ortho K added to Zerlate at 1:400 (Z-B$_1$)
15. Copper zinc chromate 4-100
16. Carbon-Carbide #658 2-100
17. Dithane D-14+zinc sulfate+lime 2-1-1/2-100
18. Fermate dust

It was recommended that each cooperator use as a minimum 5 replicates of 10 plants for each treatment and that 5 applications be put on at 10-day intervals. The method of Horsfall and Barratt for estimating defoliation was to be followed where possible.

Observations submitted by the various cooperators at the end of the season were extremely valuable in determining the form to be used in setting up the data. Diseases were of no consequence in Iowa, North Dakota, South Dakota, and South Carolina. The data from these States covering only yields and culls are itemized separately, since any differences among treatments can be attributed more to phytotoxicity than to disease control. Late blight [Phytophthora infestans] did not develop to any extent except in the Pennsylvania and Ohio tests, where it obscured for the most part defoliation due to early blight [Alternaria solani]. A relatively slight amount of late-blight fruit rot developed in the New York and New Jersey (b) plots but since infection on untreated fruits did not exceed 6 percent, with no apparent significant differences among treatments, the data are not presented in this summary. Early blight was the primary reason for defoliation in all other experiments. Septoria leaf spot (S. lycopersici] became an additional factor in the Maryland planting about the middle of August. In some States, particularly Minnesota, Michigan, and Illinois, early blight did not develop to any extent until relatively late in the season.

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[1] All materials in the South Carolina test with the exception of Dithane D-14 and Bordeaux mixture were applied as dusts.

The data have been assembled on the basis of yields in tons per acre and on percentage of culls, defoliation, anthracnose [Colletotrichum phomoides] and late-blight fruit rot. An evaluation based on yields should give a fairly good picture of over-all fungicidal efficiency, and that based on culls a measure of control of all fruit rots. No attempt has been made to subject the data to statistical analysis. Individual cooperators in some instances furnished differences necessary for significance (L.S.D.), which have been placed in the tables.

It was necessary to omit from the tables several fungicides that were used in only a very limited number of tests. Data covering these fungicides are given here so that they may be compared with other data in the tables. In the Connecticut test, defoliation (only data submitted) with Dithane D-14 was 79 percent. In South Carolina the yield from D-14 was 8.3 tons per acre. Copper zinc chromate in Michigan resulted in a yield of 4.6 tons per acre, defoliation of 53 percent and 9 percent culls; and in South Dakota, 20.8 tons per acre. Carbon-Carbide #658 was used only in New York, where plots sprayed with it give 16.1 tons, had 2.8 percent anthracnose, 55 percent defoliation and 16 percent culls. Yields from Compound A spray and Fermate dust in South Carolina were 7.7 and 9.2 tons per acre, respectively.

An efficiency rating (table 3) has been given each of the five treatments used in all tests by determining (1) number of times one treatment is better than another in each test, (2) number of times it is best of all, (3) total number, and (4) percentage of maximum possible efficiency on a comparative basis. Although this rough analysis may be somewhat better than averages in evaluating materials, comparisons within tests are even better where least significant differences are given.

Table 1. Yields per acre and percent culls -- 1947 cooperative tomato fungicide experiments.

State	Ph	78	Tr	Z	Z-T	Ck	Bo	Par	YC	Bio	Z-T$_1$	ZP	Z-B	Z-B$_1$	L.S.D.
YIELDS IN TONS PER ACRE (Nos. 1 and 2)															
Del.	12.4	14.6	13.6	13.0	12.7	12.2	11.4	14.5							n.s.
Ill.	--*	15.1	14.6	14.7	15.3	13.7			13.7						n.s.
Md.	12.6	14.3	12.5	13.5	11.9	10.1	12.6			13.7	13.8				2.30
Mich.	5.6	4.3	4.4	3.4	3.7	4.1	4.3	4.7	4.4	3.6					--
Minn.	14.0	13.2	14.0	13.5	13.4	13.2									n.s.
N.J. (1)	15.3	15.5	15.5	16.3	14.5	14.9									n.s.
N.J. (2)	18.1	18.3	18.3	19.8	20.7	14.3	20.5	17.9				19.5			1.96
N.Y.	15.8	17.4	16.3	16.3	17.1	14.3						17.1	18.1	18.4	--
Av.	13.4	14.1	13.6	13.8	13.7	12.1									
Iowa	1.8	2.2	2.6	1.9	2.7	2.1	1.4	2.5	2.5						n.s.
N.Dak.	14.3	13.9	15.7	16.4	14.4	15.1			14.7						--
S.Car.	8.0	7.8	8.4	8.4	8.8	8.7	8.1		8.4						--
S.Dak.	15.6	17.5	16.8	17.1	19.6	17.0		18.4	16.0	18.1					--
Av.	9.9	10.3	10.9	10.9	11.4	10.7			10.4						
Ohio (4)	11.9	12.6	13.4	12.8	13.7	7.8		13.0		12.0					
Pa. (2)	12.3	10.9	14.2	14.5	11.0	5.6	13.8	12.2			15.0				
PERCENT CULLS															
Del.	10.2	9.6	7.3	9.2	11.6	12.9	6.0	9.0							--
Ill.	--*	13.4	13.8	10.1	9.3	17.4			14.6						--
Md.	22.9	20.2	19.1	22.3	21.2	24.3	20.4			17.3	20.5				--
Mich.	7.0	8.0	3.0	9.0	10.0	15.0	2.0	7.0	4.0	12.0					--
Minn.	17.1	19.1	15.6	18.9	20.6	22.3									--
N.J. (1)	5.8	7.5	5.6	4.9	3.5	10.0									2.90
N.J. (2)	13.8	12.0	13.3	4.3	7.6	17.3	7.6	11.4				8.9			0.90
N.Y.	17.8	16.3	16.2	15.8	13.9	19.7						14.7	8.5	8.8	
Av.	13.5	13.3	11.7	11.8	12.2	17.4									
Ohio (4)	26.5	23.3	20.5	19.0	16.5	45.3		19.3		22.0					
Pa. (2)	32.2	29.6	21.3	41.6	33.9	52.4	18.4	32.9			22.1				

*Injury in these plots - records not completed.

Table 2. Defoliation and anthracnose - 1947 cooperative tomato fungicide experiments.

State	Ph	78	Tr	Z	Z-T	Ck	Bo	Par	YC	Bio	Z-T$_1$	ZP	Z-B	Z-B$_1$	L.S.D.
PERCENT DEFOLIATION															
Conn.	84.0	84.0	84.0	67.0	72.0	94.0	76.5	67.0	83.0						5.2
Del.	99.0	68.0	34.0	34.0	28.0	100.0	30.0	71.0							--
Ill.	--*	53.0	26.0	1.5	1.5	85.0			44.0						--
Md.	46.0	48.0	39.0	39.0	39.0	72.0	27.0			17.0	39.0				--
Mich.	51.0	55.0	43.0	55.0	57.0	65.0	39.0	55.0	40.0	56.0					--
Minn.	31.0	46.0	40.5	38.5	31.0	61.5									--
N.J. (2)	76.2	42.5	42.5	11.2	16.2	85.5	21.2	35.0				26.2			12.0
N.Y.	77.2	59.6	30.9	75.0	60.2	88.3						55.6	22.5	7.7	--
Pa.**	9	--	10	11	15	137									--
Av.	66.3	57.0	42.5	40.1	38.1	81.4									
PERCENT ANTHRACNOSE															
Del.	4.4	2.9	2.4	0.7	1.6	7.6	3.7	2.0							2.90
Ill.	--*	3.4	3.5	1.1	2.2	4.1			3.1						n.s.
N.J. (1)	3.2	5.7	4.6	1.7	1.6	7.5									2.40
N.J. (2)	34.6	33.6	34.9	16.3	24.7	45.7	27.9	32.3				27.8			8.00
N.Y.	7.3	8.7	10.2	4.1	4.1	11.7						8.2	2.0	0.8	--
Ohio (4)	6.5	5.3	7.8	1.7	4.1	8.4		6.1		3.6					--
Pa. (1)	11.4	8.2	11.4	5.9	4.3	20.0	4.6	2.5			5.8				5.28
Pa. (2)	12.7	12.1	11.3	4.9	6.1	24.2	10.7	14.5			7.8				4.80
Av.	11.4	9.9	10.8	4.5	6.1	16.1									
PERCENT LATE-BLIGHT FRUIT ROT															
Ohio (4)	8.3	7.4	1.8	8.0	4.5	35.1		4.6		8.8					
Pa. (2)	19.6	22.4	10.9	40.4	29.5	41.7	9.2	28.1			14.9				

* Injury in these plots - records not completed.

** Recorded as lesions (Alternaria) per leaf; not included in averages.

Table 3. Rating in descending order of first five treatments appearing in all tests.

	Yield		Culls		Defoliation		Anthracnose		Late blight fruit rot	
Order	Treatment	%	Treatment	%	Treatment	%	Treatment	%	Treatment	%
1.	Z-78	61.9	Trib.	76.2	Z-T	64.3	Zerl.	91.7	Trib.	100.0
2.	Trib.	52.4	Zerl.	59.5	Zerl.	61.9	Z-T	80.5	Phyg.	66.6
3.	Zerl.	52.4	Z-T	52.4	Trib.	59.5	Z-78	41.7	Z-78	50.0
4.	Phyg.	45.2	Z-78	42.9	Phyg.	35.7	Phyg.	33.3	Z-T	41.7
5.	Z-T	38.1	Phyg.	35.7	Z-78	30.9	Trib.	30.5	Zerl.	8.3

The averages in table 1 and the efficiency ratings in table 3 indicate that Dithane Z-78, although inferior in disease control, resulted in somewhat higher yields than the other four materials appearing in all tests. It should be noted, however, that Z-78 did not give highest yields in Iowa, North Dakota, South Dakota and South Carolina where diseases were almost entirely absent. Among the more promising optional treatments are (1) three applications of Zerlate followed by two of Tribasic, (2) a combination of Zerlate and Parzate and (3) Zerlate alternating with Bordeaux mixture.

From the standpoint of reduction of culls, Tribasic was superior to the other four materials. However, in Illinois, New Jersey and New York it was exceeded by Zerlate alternating with Tribasic or by Zerlate alone. Among the optional treatments, Bordeaux mixture was best in Delaware and Michigan while Zerlate alternating with Bordeaux was superior in New York.

There was but little difference in control of defoliation (early blight) among Zerlate, Zerlate-Tribasic, Parzate and Bordeaux mixture where all of these fungicides were in the same test (table 2). Bioquin 1 appeared to be definitely suprior to all other fungicides in Maryland. Yellow Cuprocide was as effective as Bordeaux and Tribasic in Michigan. Zerlate (plus a sticking agent) alternating with Bordeaux was best in New York. In Illinois Zerlate and Zerlate-Tribasic were by far the best. In general (table 3), Zerlate-Tribasic, Zerlate alone and Tribasic alone of the fungicides appearing in all tests seemed to be about equally efficient in controlling early blight.

For control of anthracnose (tables 2 and 3), Zerlate and Zerlate-Tribasic excelled all other treatments although in individual tests Parzate and Zerlate-Bordeaux were close seconds.

Bordeaux mixture and Tribasic gave best control of late blight (tables 1, 2 and 3) whether measured in yields per acre or in percent culls and fruit rot. Three applications of Zerlate followed by two of Tribasic looked promising in Pennsylvania. Dithane Z-78 and Parzate were somewhat superior to Zerlate in controlling late-blight fruit rot.

Only a few reports are available regarding phytotoxicity. In Iowa the foliage of Bordeaux-sprayed plants was curled and leathery. Yields from plants sprayed with Phygon were noticeably low but there was no visible evidence of injury to foliage or fruit. In Illinois Phygon caused such severe fruit blotching and foliage burning that these plots were abandoned. Injury was attributed to temperatures of 99° and 90° F. at the time of second and third applications, respectively.

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